COOLNEWS

A RESEARCH NEWSLETTER DEDICATED TO COOL STARS AND THE SUN

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Stellar Abstracts

A Large Stellar Coronal Loop on Algol

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The close binary Algol contains a radio-bright K subgiant star in a very close (0.062 AU), rapid (2.86 day) orbit with a main sequence B8 star. Since the rotation periods of the two stars are tidally locked to the orbital period, the consequent rapid rotation drives a robust magnetic dynamo. A large body of evidence points to the existence of an extended, complex coronal magnetosphere originating at the cooler K subgiant (Chung:2004,Mutel:1998,Ness:2004,Retter:2005). The detailed morphology of the subgiant's corona and its possible interaction with its companion are unknown, though theory predicts that the coronal plasma should be confined in magnetic loop structure (Aschwanden:2001), as seen on the Sun. Here we report multi-epoch radio imaging of the Algol system, in which we see a large, persistent coronal loop approximately one subgiant diameter in height, whose base is straddling the subgiant and whose apex is oriented toward the B star. This strongly suggests that a persistent asymmetric magnetic field structure is aligned between the two stars. The loop is larger than anticipated theoretically (Mullan:2006,Rosner:1978), but the size may be a result of a magnetic interaction between the two stars.

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For preprints via ftp orWWW: http://www.nature.com/nature/journal/v463/n7278/full/nature08643.html

Chromospheric Activity and Rotation of FGK Stars in the Solar Vicinity. An Estimation of the Radial Velocity Jitter

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Context: Chromospheric activity produces both photometric and spectroscopic variations that can be mistaken as planets. Large spots crossing the stellar disc can produce planet-like periodic variations in the light curve of a star. These spots clearly affect the spectral line profiles and their perturbations alter the line centroids creating a radial velocity jitter that might "contaminate" the variations induced by a planet. Precise chromospheric activity measurements are needed to estimate the activity-induced noise that should be expected for a given star.*Aims*: We obtain precise chromospheric activity measurements and projected rotational velocities for nearby (d $\leq$ 25 pc) cool (spectral types F to K) stars, to estimate their expected activity-related jitter. As a complementary objective, we attempt to obtain relationships between fluxes in different activity indicator lines, that permit a transformation of traditional activity indicators, *i.e*, Ca II H & K lines, to others that hold noteworthy advantages. *Methods*: We used high resolution ($\sim$ 50000) *echelle* optical spectra. Standard data reduction was performed using the IRAF ECHELLE package. To determine the chromospheric emission of the stars in the sample, we used the spectral subtraction technique. We measured the equivalent widths of the chromospheric emission lines in the subtracted spectrum and transformed them into fluxes by applying empirical equivalent width and flux relationships. Rotational velocities were determined using the cross-correlation technique. To infer activity-related radial velocity (RV) jitter, we used empirical relationships between this jitter and the $R'_{\rm HK}$ index. *Results*: We measured chromospheric activity, as given by different indicators throughout the optical spectra, and projected rotational velocities for 371 nearby cool stars. We have built empirical relationships among the most important chromospheric emission lines. Finally, we used the measured chromospheric activity to estimate the expected RV jitter for the active stars in the sample.

the name of journal, for example: Accepted by A&A

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Radiative Hydrodynamics Simulations of Red Supergiant Stars: II. Simulations of Convection on Betelgeuse Match Interferometric Observations

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Context: The red supergiant (RSG) Betelgeuse is an irregular variable star. Convection may play an important role in understanding this variability. Interferometric observations can be interpreted using sophisticated simulations of stellar convection.
Aims: We compare the visibility curves and closure phases obtained from our 3D simulation of RSG convection with CO5BOLD to various interferometric observations of Betelgeuse from the optical to the H band in order to characterize and measure the convection pattern on this star.
Methods: We use 3D radiative-hydrodynamics (RHD) simulation to compute intensity maps in different filters and we thus derive interferometric observables using the post-processing radiative transfer code OPTIM3D. The synthetic visibility curves and closure phases are compared to observations.
Results: We provide a robust detection of the granulation pattern on the surface of Betelgeuse in the optical and in the H band based on excellent fits to the observed visibility points and closure phases. Moreover, we determine that the Betelgeuse surface in the H band is covered by small to medium scale (5–15 mas) convection-related surface

structures and a large (≈30 mas) convective cell. In this spectral region, H_2O molecules are the main absorbers and contribute to the small structures and to the position of the first null of the visibility curve (i.e. the apparent stellar radius).

Accepted by A&A

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For preprints via WWW: http://arxiv.org/abs/1003.1407

Solar Abstracts

A Brief History of the Solar Oblateness. A Review.

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We present a complete review on solar oblateness measurements. By emphasizing historical data, we illustrate how the discordance between experimental results can lead to substantial improvements in the building of new technical apparatus as well as to the emergence of new ideas to develop new theories. We stress out the need to get accurate data from space to enhance our knowledge of the solar core in order to develop more precise ephemerids and ultimately build possible new gravitational theories. We emphasize how what has been learned from the solar oblateness can be transfered to other stars, for which their oblateness has been measured.

Accepted by: Journal of Atmospheric and Solar Terrestrial Physics

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A Photospheric Bright Point Model

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A magneto-hydrostatic model is constructed with spectropolarimetric properties close to those of solar photospheric magnetic bright points. Results of solar radiative magneto-convection simulations are used to produce the spatial structure of the vertical component of the magnetic field. The horizontal component of magnetic field is reconstructed using the self-similarity condition, while the magneto-hydrostatic equilibrium condition is applied to the standard photospheric model with the magnetic field embedded. Partial ionisation processes are found to be necessary for reconstructing the correct temperature structure of the model. The structures obtained are in good agreement with observational data. By combining the realistic structure of the magnetic field with the temperature structure of the quiet solar photosphere, the continuum formation level above the equipartition layer can be found. Preliminary results are shown of wave propagation through this magnetic structure. The observational consequences of the oscillations are examined in continuum intensity and in the Fe I 6302Å magnetically sensitive line.

Accepted by A&A

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For preprints via WWW: http://star.pst.qub.ac.uk/∼dbj/Publications/Shelyag_2010.pdf

Microflare Activity Driven By Forced Magnetic Reconnection

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High-cadence, multiwavelength optical observations of a solar active region (NOAA 10969), obtained with the Swedish Solar Telescope, are presented. Two magnetic bright points are seen to separate in opposite directions at a constant velocity of 2.8 $\mathrm{km s^{-1}}$. After a separation distance of $\approx$4400 km is reached, multiple Ellerman bombs are observed in both Hα and Ca-K imaging. As a result of the Ellerman bombs, periodic velocity perturbations in the vicinity of the magnetic neutral line, derived from simultaneous MDI data, are generated with amplitude $\pm$6 $\mathrm{km s^{-1}}$ and wavelength $\approx$1000 km. The observed velocity oscillations provide the magnetic-field deformation necessary to trigger forced reconnection, with the subsequent microflare activity demonstrating an Hα-wing intensity enhancement of 63%. A time delay of $\approx$3 min between Hα-wing and Ca-K observations indicate that the observed magnetic reconnection occurs at a height $\approx$200 km above the solar surface. These observations are consistent with theoretical predictions and provide the first observational evidence of microflare activity driven by forced magnetic reconnection.

Accepted by ApJ Letters

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For preprints via WWW: http://star.pst.qub.ac.uk/~dbj/Publications/Jess_microflare.pdf

Long-Term Solar Activity Influences on South American Rivers

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River streamflows are excellent climatic indicators since they integrate precipitation over large areas. Here we follow up on our previous study of the influence of solar activity on the flow of the Paraná River, in South America. We find that the unusual minimum of solar activity in recent years have a correlation on very low levels in the Paraná's flow, and we report historical evidence of low water levels during the Little Ice Age. We also study data for the streamflow of three other rivers (Colorado, San Juan and Atuel), and snow levels in the Andes. We obtained that, after eliminating the secular trends and smoothing out the solar cycle, there is a strong positive correlation between the residuals of both the Sunspot Number and the streamflows, as we obtained for the Paraná. Both results put together imply that higher solar activity corresponds to larger precipitation, both in summer and in wintertime, not only in the large basin of the Paraná, but also in the Andean region north of the limit with Patagonia.

Accepted by Journal of Atmospheric and Solar-Terrestrial Physics

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For preprints via WWW: http://arxiv.org/abs/1003.0414

Upcoming Meeting

Astronomy of Exoplanets with Precise Radial Velocities

16 - 19 August 2010

Penn State University (University Park, PA)

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WORKSHOP DESCRIPTION:

This workshop will be devoted to a thorough discussion of the current capabilities and a future potential of the radial velocity technique to discover and characterize exoplanets. Emphasis will be placed on future developments in instrumentation, calibration techniques, and data analysis algorithms to further improve the precision of radial velocity measurements at visible and near-infrared wavelengths. A special session is planned to review applications of precise radial velocity measurements beyond exoplanet detection, including astroseismology and cosmology.

Further announcements will be posted on the websites of the CEHW (http://exoplanets.astro.psu.edu) and the NExScI (http://nexsci.caltech.edu).

SOC:

Chas Beichman (NExScI), Bill Cochran (UT Austin), Debra Fischer (Yale), Artie Hatzes (Jena), Hugh Jones (Hertfordshire), Stephen Kane (NExScI), Dave Latham (CfA), Christophe Lovis (Geneva), Geoff Marcy (UBC), Michel Mayor (Geneva), Andrzej Niedzielski (TCfA), Francesco Pepe (Geneva), Larry Ramsey (PSU), Bun'ei Sato (TITech), Alex Wolszczan (PSU, chair)

LOC:

Chad Bender (PSU), Dawn Gelino (NExScI), Sara Gettel (PSU), Stephen Kane (NExScI), Suvrath Mahadevan (PSU), Peter Plavchan (NExScI), Stephen Redman (PSU), Matt Route (PSU), Steinn Sigurdsson (PSU), Richard Wade (PSU), Jason Wright (PSU, chair).

Job Openings

Ph.D. Studentships

Extrasolar Planets

Centro de Astrofisica da Universidade do Porto (Portugal)

The Centro de Astrofisica da Universidade do Porto (CAUP) opens a call for 3 PhD student positions. The positions are offered in the context of the Starting Grant "EXtra-solar planets and stellar astrophysics: towards the detection of Other Earths" funded by the European Community/European Research Council under the FP7 Ideas programme.

The positions, with a maximum duration of 4 years, are open in the field of extra-solar planets, and are to be started from the 1st of October 2010.

The PhD fellowship (according to the rules of the National Science Foundation FCT) have an yearly income of nearly 12 000 euros, tax free. Funds for traveling (conferences, collaborations, observing missions) are also available.

The above mentioned research is to be seen in the context of the participation in the project of the ESPRESSO@VLT instrument (http://espresso.astro.up.pt), a new high resolution ultra stable spectrograph for the VLT/ESO.

Details on the application can be found in: http://www.astro.up.pt/caup/index.php?WID=141&Lang=uk&CID=1&ID=56

The deadline for application is the 31th of May 2010.

Submitted by: Nuno Santos (Nuno.Santos@astro.up.pt)

Abstract Guidelines

Abstracts for *COOLNEWS* are solicited for papers that have been recently accepted by or submitted to refereed journals, and for recent Ph.D. theses. Abstracts for conference proceedings articles are *not* posted in *COOLNEWS*. The subject matter should pertain directly to cool stars (spectral types F,G,K,M or L), substellar objects, or the sun. Both theoretical and observational abstracts are appropriate.

Abstracts dealing with cool pre-main-sequence (PMS) stars will generally not be included in *COOLNEWS*, since they are already covered by the *Star Formation Newsletter*. Exceptions to this rule will be considered if the subject matter is truly cross-disciplinary. If you wish to submit a cross-disciplinary abstract on PMS stars, then first submit it to the *Star Formation Newsletter*. After doing so, submit the abstract to *COOLNEWS* accompanied by a short e-mail stating that it has already been submitted to the *Star Formation Newsletter*, and summarizing why it will be of interest to the cool star/solar community at large.

A monthly call for abstracts will be issued and abstracts received by the last day of the month will usually appear in the following month's newsletter. Announcements of general interest to the cool star and solar communities may also be submitted for posting in the newsletter. These might include (but are not restricted to) the following: (i) *Job Openings* directed toward cool star or solar researchers, (ii) announcements of *Upcoming Meetings*, (iii) announcements of *Upcoming Observing Campaigns* for which participation is solicited from the community at large, (iv) reviews of *New Books*, and (v) *General Announcements* that provide or request research-related information. Please send all correspondence to the editor at coolnews@jila.colorado.edu. Abstract templates and back issues can be obtained from the COOLNEWS Web-page at

`http://casa.colorado.edu/~skinners/coolnews.html` .

*** Please send abstracts in the body of the message and *not* as attachments.***